Theresa Rice

From: Bainbridge Citizens [gary@tripp.net]
Sent: Friday, August 19, 2011 8:57 AM
To: *Bainbridge Citizens
Subject: Understanding buffer science is not difficult
Attachments: Thirty-foot Buffer Mystery.pdf

C.O.B.I.
AUG 22 2011
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Dr. Flora solves The Thirty-foot Buffer Mystery for the City Council.

Even for heavy pollution from farming, a 20 to 30 foot grass buffer removes most pollutants. **See Attached**

Understanding buffer science is not difficult.

1. **The pollution is best controlled at the source**

2. **The larger the pollution load - the larger the buffer** needed to trap the pollution.

3. **Most of the pollution is removed in the very first part of the buffer**

The buffer science comes from studies on LARGE pollution sources like cattle feed lots, commercial row crops (farming), and timber harvests. **Remember: large pollution = large buffers.**

Studies of pollution from farms have shown that a **15-foot grass buffer** can remove up to **80% of the nitrogen** and a **5-foot grass buffer** can remove up to **90% of the sediment**. Small buffers are very effective and efficiency.

Bainbridge's largest source of pollution is street runoff, not residential uses.

Everything from the whole Island flows downhill into our creeks and then into the Sound; education on how to avoid the use of chemicals will have a positive impact.

The Island only needs small buffers and **education**.

By Gary Tripp

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17 August 2011

Bainbridge Island City Council

Re: The thirty-foot buffer mystery

At your SMP meeting on the 16th one of you pressed a Herrera rep to explain their proposed width of 30 feet for a Zone 1 (nearest-to-tidewater) buffer. The response was vague.

I don't know the origin of the magic 30 figure but I offer a plausible rationale. Then I challenge it.

Why thirty feet?

Among the references in the August 2 Herrera memo are two that, together, compile results from close to a hundred buffer research studies.[1] I've enclosed graphs from the two references. They plot removal effectiveness against buffer width, for stormwater-carried pollutants. Each point reflects a study somewhere.

You'll notice the considerable variation in efficacy, reflecting factors other than buffers' widths.[2] You'll see that the curves, installed using regression analysis, arch to the right, reflecting diminishing returns as buffers widen.

Notice also that the curves' slopes start to ease between 20 and

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[1] Desbonnet, Alan, et al. 1994. Vegetated buffers in the coastal zone - A summary review and bibliography. Narragansett: University of Rhode Island, Graduate School of Oceanography.

Zhang, Xuyang, et al. 2010. A review of vegetated buffers and a meta-analysis of their mitigation efficacy in reducing nonpoint source pollution. Journal of Environmental Quality 39 (Jan-Feb) 76-84.

[2] Largely unknown outside the research community is the low overall correlation between protection and buffer widths. An EPA review of 46 studies showed that only 14 percent of the variation in protection could be explained by buffer widths. In an analysis of 29 studies I found only 11 percent explained for phosphorus and 10 percent for nitrogen. These figures mean that 85-90 percent of the variation found among buffers' pollutant protection is related to factors other than buffer width.

30 feet of width (6 to 9 meters). This is partly because of the mathematical functions fitted to the data. It is possible that Herrera trusted the curve fitters.

But why not twenty feet?

The vertical scatter of points in the graphs is so broad that one can just as easily regard 6 meters as curve-consistent, especially if one uses a slightly different math function. A little less efficacy perhaps, but not much less. Now assume the fitted curves aren't there. The points can tell a 6-meter story as well as one about 9 meters.

Meanwhile, percentage of what?

In either case these data, and most pollutant-buffer studies, express success in the *proportion* of bad stuff halted, not the *amount*. The research amounts are typically very large relative to quantities apt to come from residential places. 25-percent capture of nutrients or pesticides from feedlots or intensive farming can equal many times the worst-case discharges from Bainbridge home places. I've enclosed a paper that puts numbers on the matter.

All of which begs the issue...

...of whether we have any measurable shoreward discharges of pollutants from waterfront residential properties. Does dog poop sweep to the beach from landscaped yards? Would poop producers congregate in buffers? I've found no data.

Don Flora

cc: Shoreline Planning Staff

ZHANG

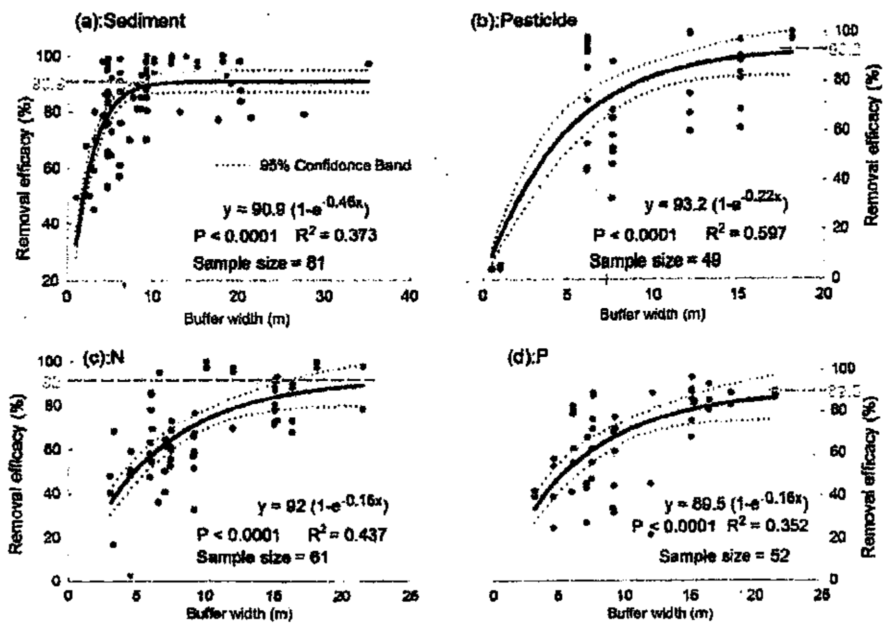

Fig. 3. Pollutant removal efficacy vs. buffer width for each pollutant. Black dots are data and lines are model predictions. Dotted red lines indicate 95% confidence band. The limiting value of *K* is shown in pink with a dotted line. Details of the model are given in each figure for (a) sediment, (b) pesticides, (c) N, and (d) P.

DESBONNET

Figure 4.

Figure 4. Relationship of percent removal to buffer width for the treatment of sediments contained in surface water runoff. An approximate increase in vegetated buffer width by a factor of 3.5 is required to achieve a 10 percent improvement in removal of sediment. The most efficient vegetated buffers, based upon width-to-removal ratios, will be about 25 meters in width, after which large additions of buffer width are required to achieve only small increases in sediment removal efficiency. The modeled line is: % removal = [(7.613 * ln(width in meters)) + 55.8]. Data are taken from Table 4. [1 meter = 3.28 feet]

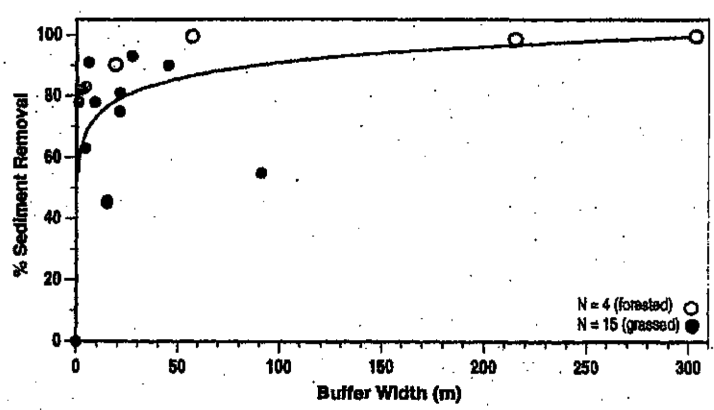

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Figure 6.

Figure 6. Relationship of percent removal to buffer width for the treatment of nitrogen contained in surface water runoff. An approximate increase in vegetated buffer width by a factor of 2.6 is required to achieve a 10 percent improvement in removal of nitrogen. The most efficient vegetated buffers, based upon width-to-removal ratios, will be about 60 meters in width, after which large additions of buffer width are required to achieve only small increases in nitrogen removal efficiency. The modeled line is: % removal = [(10.5 * ln(width in meters)) + 37.4]. Data are taken from Table 4. [1 meter = 3.28 feet]

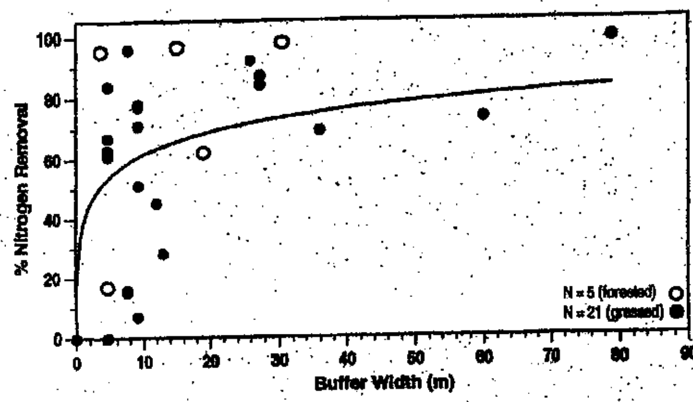

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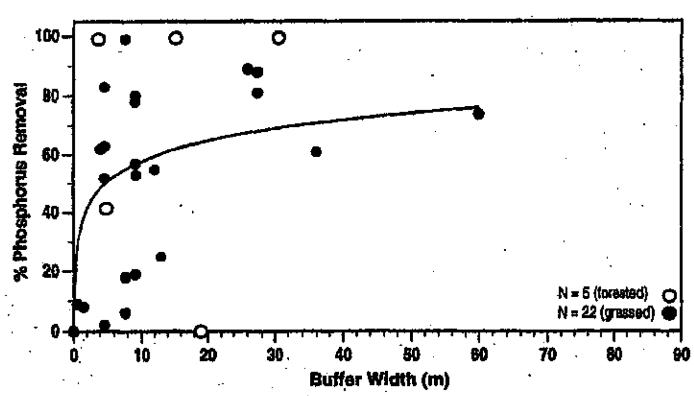
Figure 8.

Figure 8. Relationship of percent removal to buffer width for the treatment of phosphorus contained in surface water runoff. An approximate increase in vegetated buffer width by a factor of 2.5 is required to achieve a 10 percent improvement in removal of phosphorus. The most efficient vegetated buffers, based upon width-to-removal ratios, will be be about 75 meters in width, after which large additions of buffer width are required to achieve only small increases in phosphorus removal efficiency. The modeled line is: % removal = [(10.3 * ln(width in meters)) + 34.1]. Data are taken from Table 4. [1 meter = 3.28 feet]



April 2010

NEAR-ZERO BUFFERS: THEY CAN WORK

Don Flora

Want to corral the nutrient discharges from 1200 people confined in a single acre? Probably not: not even Woodstock achieved that level of togetherness. But if you did, what would it take?

A buffer about 70 feet wide. Even in hard rain.

How do we know? It's been done[1]; not next to a love-in but rather at a Minnesota feedlot for cattle, each of whose residents exuded nitrogen and phosphorus equal to about 13 people.[2] That 70-foot grassed buffer caught about 98 percent of vagrant nutrients.

Is this capture rate typical? Well, read on.

Much narrower buffers can suppress stormwater-carried nutrients. A 15-foot buffer did just fine in a Virginia study.[3] Nutrients equal to the output of about 5-1/2 people per acre (far more common than 1200) were applied to cropland. Of the departing rain-driven nitrogen, for instance, over 80 percent was halted in that 15-foot grass buffer.

In Kentucky livestock waste equal to that of 20 people per acre had a negligible impact on nutrient content of runoff from a research pasture.[4] No buffer required.

In western Oregon nitrates were applied to a grass-seed farm field at about the same rate as if sewage from 6-1/2 people per acre missed the drainfield and spread upon the land. As stormwater left the field the nitrates it carried completely disappeared within 20 feet of passage through a weedy buffer.[5]

All of these studies were done on slopes like those of most Kitsap home places. In short, all across the country, short buffers can work.

1. 136 steers per acre. Young, R. A., et al. 1980. Effectiveness of vegetated buffer strips in controlling pollution from feedlot runoff. Journal of Environmental Quality 9(3):403-487. Cited in Brooks, Kenneth M. 2007. Supplemental best available science supporting recommendations for buffer widths in Jefferson County, Washington. On file at Jefferson County Department

of Community Development, Port Townsend, WA.

2. American Society of Agricultural Engineers. 2003. Manure production and characteristics, ASAE Standard D384.1. St. Joseph, MI.

Adamus, Paul R. 2007. Best available science for wetlands of Island County, Washington: Review of Published Literature. Corvallis, OR: Adamus Resource Assessment, Inc. Corvallis, OR.

3. Dillaha, T. A., et al. 1989. Vegetative filter strips for agricultural nonpoint source pollution control. Transactions of the American Society of Agricultural Engineers 32(2):513-519.

4. Edwards, D. R., et al. 2007. Runoff nutrient and fecal coliform content from catle manure application to fescue plots. Journal of the American Water Resources Association 36(4):711-721.

5. Davis, Jennifer J., et al. 2007. Mitigation of shallow groundwater nitrate in a poorly drained riparian area and adjacent cropland. Journal of Environmental Quality 36:628-637.